

**Research
Development
and Technology**

Missouri
Department
of Transportation

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Void Detection with the Falling Weight Deflectometer

Description:

The practice of good preventive maintenance requires attention to bridge and roadway features that have not yet deteriorated to the point of obvious physical distress. By detecting certain symptoms, such as in this case, the development of voids underneath pavement slabs at bridge approaches, the Missouri Department of Transportation (MoDOT) can, either with its maintenance forces or by contract, apply remedial treatments at an early stage and avoid costly full-scale rehabilitation or replacement at a later date.

**MoDOT FWD**

The falling weight deflectometer (FWD), which has proven to be an effective tool for evaluating the stiffness of hot mix asphalt (HMA) and Portland cement concrete (PCC) pavement layers and their subgrades, and the load transfer at PCC pavement joints, can also be used to detect voids at PCC pavement joints.

The RD&T Division conducted FWD testing in 1999 on over 200 joints at 27 bridges spread across Lawrence, Jasper, and MacDonald counties on I-44 and US 71. An attempt was made to check the three or four slabs closest to both sides of each structure. Tests were conducted on the leave side of the joint near the outside corner of the driving lane. Load levels were approximately 9,000, 12,000, and 16,000 pounds.

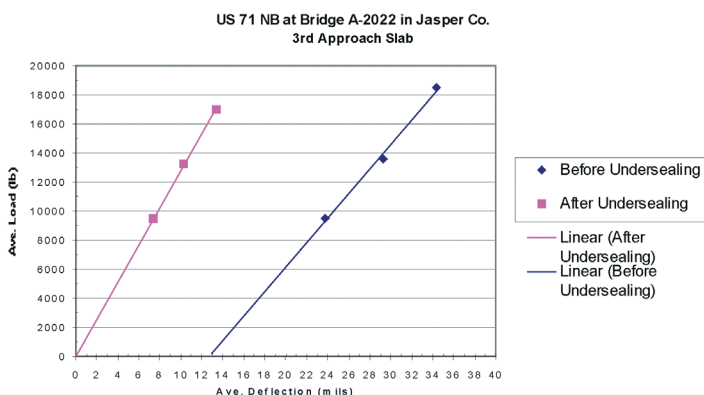
Load versus deflection graphs were plotted for each joint in accordance with AASHTO Guide for Design of Pavement Structures procedures, which adopted recommendations from the NCHRP 1-21 Final Report. The linear trend line for each joint was backcast to its deflection x-axis intercept. A marginal undersealing candidate met the deflection axis between three and seven mils (0.001"), while a strong undersealing candidate equaled or exceeded seven mils. A total of 27 joints were recommended for undersealing.

MoDOT District Seven had a contractor underseal the joints with polyurethane during the Spring of 2001. FWD testing was performed on 22 of the 27 undersealed joints in

the Spring of 2002. The other five joints had either been replaced with full-depth repairs or mistakenly omitted during the undersealing.

Results:

Plots of load versus deflection were generated and compared with pre-undersealing data. Sixteen of the 22 slabs showed positive reduction in deflections after undersealing. The average reduction for the 16 improved slabs was 12.7 mils.



Recommendations:

The FWD should be used for determining voids under PCC slabs, assuming the FWD is available, when conventional proof roll testing is not desirable because of lane closure time restrictions, unstable pavement shoulders to set the proof roll measurement apparatus on, and/or the need for more clear and quantifiable indications of undersealing improvements.

For more information, contact:

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